Jan. 15, 1935. S. P. VAUGHN 1,988,345

SNAP ACTION DEVICE

Filed July 17, 1933

Fig-1

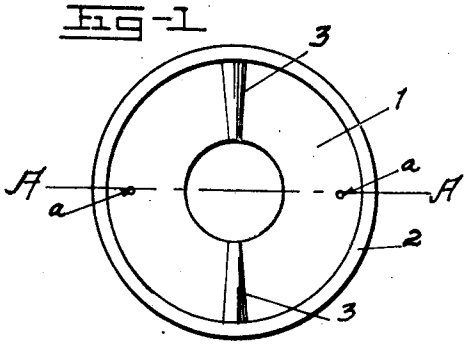


Fig-2

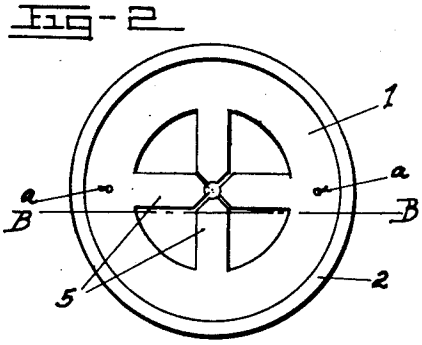


Fig-3

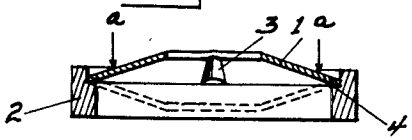


Fig-4

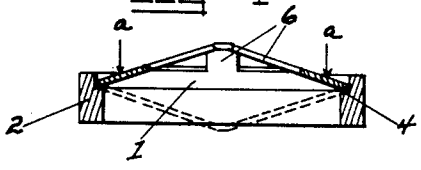


Fig-5

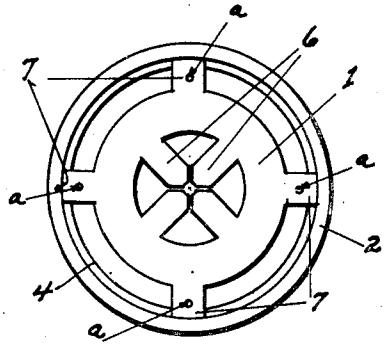


Fig-6

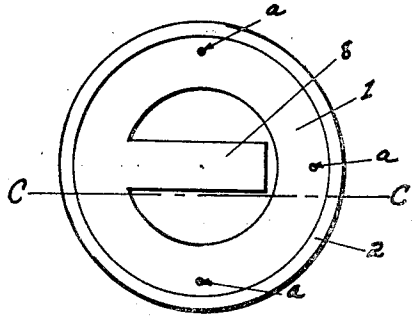


Fig-7

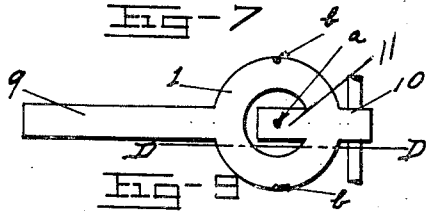


Fig-8

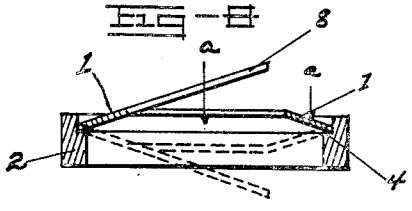
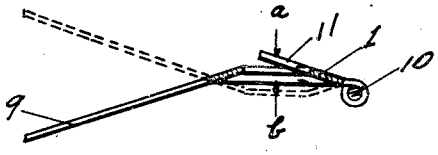


Fig-9



Sidney P. Vaughn

INVENTOR

Patented Jan. 15, 1935 1,988,345

UNITED STATES PATENT OFFICE

1,988,345

SNAP ACTION DEVICE

Sidney P. Vaughn, United States Navy,
Ackerman, Miss.

Application July 17, 1933, Serial No. 680,823

20 Claims. (Cl. 74—100)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

My invention relates to snap action devices in general, but more particularly to snap action devices used in thermostats to operate valves and electric switches with a snap action.

The principal object of my invention is to provide a snap action device having two opposed limiting positions so constructed out of a plate of spring metal that it may be actuated from one position to another with a snap action with a greater movement than has been possible to obtain with similar devices of the same size heretofore used.

Heretofore similar snap action devices have been formed concavo-convex out of thin spring metal and are commonly known as a snap disk or clicker disk. With such a construction the center of the diaphragm or disk has a very limited movement which can only be increased by increasing the diameter of the disk, and if excessive pressures are applied the distortion is liable to become permanent and make the disk inoperative. In some snap disks made out of bi-metallic or thermostatic metal, the metal has been cut away to decrease the strains set up in the metal, but the movement of the center of the disk has not been appreciably increased.

In practicing my invention I provide an element made out of thin spring metal formed in the shape of a hollow frustum of a cone, which will be referred to herein as a conical ring. If the angles of the walls of the cone relative to the base line are not excessive, the conical ring may be snapped into a reverse form by applying a yielding pressure to the top side of the cone at any point between the inner and outer edge of the ring. The angularity of the walls of the cone with reference to the base line determines whether the device will regain its normal form when the pressure is removed. If the angles are small say within eight degrees, the device will regain its normal form. If the angles are greater than eight degrees, the device will not regain its normal form, and a reverse pressure will be necessary to force it back. The width of the ring and the thickness of the metal also have a great deal to do with the property of regaining its normal form.

Another object is to provide means to amplify any movement of the ring, and to accomplish this I provide arms extending radially from either edge of the conical ring, depending upon the use of the device.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawing, and the novel features will be particularly pointed out in the description and in the appended claims:

Referring to the drawing:

Fig. 1 is a plan view of my invention in its simplest form.

Fig. 2 is a plan view of a modified form of my invention.

Fig. 3 is a sectional view on line A—A Fig. 1.

Fig. 4 is a sectional view on line B—B Fig. 2.

Fig. 5 is a plan view of another modified form of my invention.

Fig. 6 is a plan view of another modified form.

Fig. 7 is a plan view of another modified form.

Fig. 8 is a sectional view on line C—C Fig. 6.

Fig. 9 is a sectional view on line D—D Fig. 7.

Like numerals refer to like parts throughout the several views.

The device of my present invention is illustrated in its simplest form in Figs. 1 and 3, and comprises a plate 1 of spring material formed in the shape of a hollow frustum of a cone with an opening in the top. The peripheral edge of the conical ring rests on an annular shoulder 4 formed in a suitable holder or support 2. When a yielding pressure is applied at the points indicated by the arrows (a) or at any other point on the top of the conical ring between the inner and outer edges, the device will snap into a reverse form as indicated by the dotted lines in Fig. 3. This type of device may be formed so as to have the property of regaining its normal form when the pressure is removed, or, it may be formed so that it will retain its reverse form, depending upon the angularity of the walls of the conical ring with reference to the base line, the cross sectional width of the ring, and the thickness of the metal. One simple method of manufacturing this type of snap device out of tempered spring steel is to crimp the metal as indicated by the crimps 3 shown in Fig. 1. A softer metal may be formed without crimping.

Figs. 2 and 4 illustrate a modified form of the snap device, and comprises a conical ring 1 having radial arms or spokes 5 extending inwardly from the inner edge of the ring 1, but disconnected at the center as shown. Pressure applied to the top side of the conical ring as indicated by the arrows (a) will cause the device to snap into a reverse form as indicated by the dotted lines

in Fig. 4, in the same manner as that illustrated in Fig. 3 except that the travel of the ends of the arms 5 is greater than the travel of the inner edge of the conical ring. This form of snap device is particularly adaptabe for operating valves with a snap action where a wide valve opening is desired.

Fig. 5 illustrates another modified form of my invention and comprises the conical ring 1 having the form of a hollow frustum of a cone, provided with arms 6 extending radially toward the center but disconnected, and arms 7 extending radially from the peripheral edge of the conical ring, formed integrally therewith and having the same angle with reference to the base line as the walls of the conical ring. The ends of the arms 7 rest on an annular shoulder 4 in the holder or support 2. A pressure applied at any point on top of the arms 7 as indicated by the arrows (*a*) will cause the device to snap suddenly into a reverse form. The arms 7 are resilient and flex when the pressure becomes excessive, thereby relieving the conical ring of any stresses that are liable to cause a permanent distortion when snapped into a reverse form. This form of device provides a maximum movement for the ends of the arms 6 extending toward the center of the snap device, and may be used for many purposes.

Figs. 6 and 8 illustrate another modified form of my invention and comprises a conical ring 1 having an arm 8 extending diametrically from the inner edge of the ring across the opening and having the same angle with reference to the base line as the walls of the conical ring as illustrated in Fig. 8. A yielding pressure applied on the top of the conical ring between the inner and outer edge as indicated by the arrows (*a*) will cause the device to snap into a reverse form as indicated by the dotted lines in Fig. 8. This form of snap device provides a maximum movement of the ends of the arm and is particularly desirable where compactness is desired in a thermostatic device.

Figs. 7 and 9 illustrate another modified form of my invention and comprises a conical ring 1 hinged by a section of its peripheral edge to a pin 10 and having an arm 9 extending radially from the opposite peripheral edge. An arm 11 attached to the inner edge adjacent the hinged portion extends diametrically across the opening formed by the ring. Both arms have the same angle with reference to the base line as the walls of the conical ring 1. When a pressure is applied to the top side of the arm 11 as indicated by the arrow (*a*) and is resisted by an opposing pressure applied to the under side of the peripheral edge of the conical ring as indicated by the arrows (*b*) the device will snap into a reverse form and the arm 9 will take the position indicated by the dotted lines in Fig. 9. This form of snap device is applicable to electric switches where a large opening is desired between contact points.

While I have illustrated the snap device as being actuated by external means, it may be made out of bi-metallic or thermostatic metal and the movement caused by variation in temperatures.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope of the appended claims.

I claim:

1. A snap action device comprising a plain plate of spring material having the form of a hollow frustum of a cone for establishing two opposed limiting positions to which it may be actuated with a snap motion when opposing pressures are applied at predetermined points on the top and bottom side of the cone.

2. A snap action device comprising a plain plate of spring material having the form of a hollow frustum of a cone for establishing two opposed limiting positions to which it may be actuated, and one or more arms extending from the inner edge of the cone to amplify any movement of the cone.

3. A snap action device comprising a plain plate of spring material having the form of a hollow frustum of a cone for establishing two opposed limiting positions to which it may be actuated, and one or more arms extending from the peripheral edge of the cone to support and amplify any movement of the cone.

4. A snap action device comprising a plain plate of spring material having the form of a hollow frustum of a cone for establishing two opposed limiting positions to which it may be actuated, and one or more arms extending from the inner edge and one or more arms extending from the peripheral edge to amplify any movement of the cone.

5. A snap action disk having two opposed limiting positions and adapted to being actuated from one to the other of said positions with a snap action, said disk having a plurality of arms extending from the peripheral edge to support the disk and amplify any movement of the inner edge when the disk is snapped into a reverse form.

6. A snap action disk having two opposed limiting positions and movable from one to the other of said positions with a snap action, said disk having the central portion cut out and an arm extending radially from the inner edge diametrically across the opening with one end free to amplify any movement of the disk.

7. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when oppositely applied and unaligned concentric forces are applied thereto to change the central portion thereof from a plane on one side of the plane of the peripheral edge to a plane on the opposite side of the plane of the peripheral edge.

8. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, and one or more arms extending from the inner edge of the ring to amplify any movement thereof.

9. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, and one or more arms extending from the inner edge and the peripheral edge of the ring to amplify any movement thereof.

10. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, and one or more arms extending from the peripheral edge of the plate ring to support the device and permit the peripheral

edge thereof to change from one plane to another when it is actuated from one of its opposed positions to the other.

11. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, and an arm extending from the inner edge of the ring to amplify any movement thereof, said arm having a length greater than the radius of the opening in the ring.

12. A snap action device comprising a plain plate ring of spring material having the general shape of a truncated tubular cone and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, means for pivoting the plate ring by its peripheral edge, and one or more arms extending from the peripheral edge opposite to the pivotal point to amplify any movement of the plate ring when it is actuated from one position to the other.

13. A snap acting device comprising a bi-metallic thermostatic conical ring adapted to assume a position of opposite configuration under the influence of temperature changes and arms extending from the peripheral edge of the ring to support the ring and permit the peripheral edge to move to a different plane when the ring is snapped into a reverse form.

14. A device as set forth in claim 13 and arms extending from the inner edge to amplify any movement of the inner edge.

15. A device as set forth in claim 5 wherein the ring portion is made out of bi-metallic thermostatic metal and adapted to assume two positions of stable equilibrium under the influence of temperature changes.

16. A snap acting device comprising an annulus of spring material and having the property of attaining one of two opposed limiting positions when forces are properly applied thereto, and one or more arms extending from the inner edge of said annulus to amplify any movement thereof, said arms having a length greater than the radius of the opening in said device.

17. A snap-acting thermostat comprising an annulus of composite thermostatic material, and one or more arms extending from the inner edge of said annulus to amplify any movement thereof, said arms having a length greater than the radius of the opening in said device.

18. A snap-acting thermostat comprising an annulus of composite thermostatic material and having the plane of its inner edge displaced from the plane of its outer edge, one or more arms extending from the inner edge, and one or more arms extending from the outer edge, said arms acting to amplify any movement of the annular portion.

19. A snap acting thermostat comprising an annulus of composite thermostatic material and having the plane of its inner edge displaced from the plane of its outer edge, means for pivoting the outer edge, and one or more arms extending from the outer edge opposite to the pivotal point to amplify any movement of the annular portion.

20. A snap acting device comprising an annulus of resilient material, the plane of the inner edge thereof being displaced from the plane of the peripheral portion thereof, whereby when suitably actuated, it overcenters and assumes a position of opposite configuration, and one or more arms extending from the inner edge thereof and having a length greater than the radius of the opening formed by the annulus.

SIDNEY P. VAUGHN.